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ABSTRACT

EUV mask surface cleaning effects on lithography process performance

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The reflective, multilayer based, mask architectures for EUV lithography are highly susceptible to surface oxidation and contamination. As a result, EUV masks are expected to undergo cleaning processes in order to maintain the lifetimes necessary for high volume manufacturing. Several mask cleaning methods are being investigated currently [1]. Mask surface damage and the increased LER that may result from the cleaning processes and the number of cleaning cycles applied still remains a concern. To date, there are no reported studies that directly compare patterning performances of a mask before and after the surface cleaning applications.

We previously reported process performance comparison for the SEMATECH Berkeley 0.3 NA micro-field exposure tool (MET) printed 40 nm and 50 nm line and space (L/S) patterns from a contaminated mask that was cleaned to a new and uncontaminated mask. Our findings indicated that the lithography process performance was not significantly affected by the cleaning process. In this paper, we will present a direct comparison of the effects of EUV mask cleaning methods on patterning with the 0.3NA MET. Process data collected before and after the mask cleaning cycles will be evaluated in detail in order to quantify any process changes.

1. Chemical effect of dry and wet cleaning of the Ru protective layer of the extreme ultraviolet lithography reflector, Leonid Belau, Jeong Y. Park, Ted Liang, Hyungtak Seo, and Gabor A. Somorjai, J. Vac. Sci. Technol. B 27, 1919 (2009)

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